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VERBAL CONDITIONING, AWARENESS, AND INTELLIGENCE

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The effect of intelligence on verbal conditioning and awareness of the conditioning contingencies were investigated. Findings show that more intelligent subjects were conditioned sooner than less intelligent subjects and they verbalized their awareness of the contingencies more often than less intelligent subjects.

Verbal operant conditioning, customarily known as "verbal conditioning", has recently aroused considerable interest. It is a label for a situation in which an experimenter (*E*) sets out to deliberately modify a subject's (*S*'s) verbal output through the provision of reinforcing stimulus cues in a systematic manner. Greenspoon is credited with having sparked this surge of interest in verbal conditioning research. In 1950 he described an experiment in which the *S*s were unable to report either the reinforcing stimuli or the change in their behavior. This triggered off investigations to verify his reported automaticity of verbal behavior. Studies like those of Spielberger and DeNike (1966) came up with contrasting results. They gave evidence of the significant role of awareness in verbal conditioning.

In a recent article, Krasner (1967) presented evidence of a group of investigators who questioned Spielberger and DeNike's contention. They argued that awareness was a dependent variable in the verbal conditioning situation which could in itself be influenced directly by reinforcement or indirectly by manipulating the variables which influence conditioning.

Some investigators hinted at the possible role of intelligence in verbal conditioning and awareness. Krasner (1958), for instance, cited that in a novel situation such as verbal conditioning in which the *S* has no prior knowledge of what constitutes a correct response, intelligent individuals will be relatively more likely than low intelligent ones to seek actively cues in an ambiguous situation. His notion is related to the belief that a verbal conditioning situation can be conceptualized as some kind of a problem-solving task.

Farber (1963) observed that since it appears that symbolic mediational processes are likely to bear a heavy burden in the explanation of verbal conditioning, it may well be that we shall be able to account for some of the variance in verbal conditioning scores in terms of individual differences in intelligence or academic aptitude. A stimulating verbal conditioning experiment by Lanyon (1964) showed that only those who were aware of the response-reinforcement contingency became conditioned. His conditioning task was presumably difficult to learn. As such he insinuated the question of whether aware *S*s were more intelligent than unaware *S*s.

Krasner (1965) indirectly pointed to the possibility of intelligence as mediating awareness and performance on a verbal conditioning task. He claimed that verbal conditioning could be an

analogue of psychotherapy. Both imply modification of behavior. In psychotherapy, specifically the client-centered type, insight or awareness of the therapeutic situation is considered essential for behavior change to occur. The development of insight naturally requires intelligence.

This paper is an attempt to investigate the extent to which intelligence affects performance on a verbal conditioning task. The main objective of the study was to determine differences in rate of conditioning at various levels of intelligence. Intelligence was defined in terms of scores on the Otis Self-administering Test of Mental Ability and the DAT Abstract Reasoning Test. Four levels of the independent variable were used, the first level being made up of *Ss* who scored high in both tests (HH Group), the second, of *Ss* who scored high in the verbal test but low in the nonverbal test (HL Group), the third, of *Ss* who scored low in the verbal test but high in the nonverbal (LH Group), the fourth, of *Ss* who scored low in both tests (LL Group). The dependent variables were performance on the verbal conditioning task and awareness. A subject was considered aware if he was able to verbalize the relationship between the reinforcement stimuli and the response. The verbalized relationship was one that could be described as either a correct or a correlated hypothesis. A hypothesis was correlated if the response the subject called correct was correlated with the response the E called correct. A post-hoc exploration was made to determine the relationship between intelligence level and reports of awareness through the questionnaire and interview.

It was predicted that intelligence would have a positive relationship with conditioning rate and reports of awareness, that is, that high-intelligent *Ss* would become aware of the response-reinforcement contingency and condition quicker than the low-intelligent *Ss*.

METHOD

Subjects

One hundred freshmen, aged 16 to 18, were drawn from a total of 2,000 students who took the OTIS and the DAT subtest. They were assigned to the different levels of intelligence according to scores on the OTIS and the DAT Subtest and the teacher's rating. The characteristics of the total sample with respect to age, and scores in the OTIS and the DAT Abstract Reasoning tests of mental ability is presented in Table 1. An additional criterion (Teachers' rating) was used in assigning *Ss* to the first and fourth levels of the independent variable. Those who were assigned to the first level were also judged by their teachers as belonging to the top five in their respective classes, and those in the fourth level, to the bottom five. It is to be noted here that the main purpose of this study was to compare the performance of high-intelligent *Ss* (HH Group) and low-intelligent *Ss* (LL Group). The inclusion of the HL and the LH Groups was done only as a matter of interest. For this reason the criterion of teachers' rating was not applied to *Ss* assigned to these groups in addition to the fact that it was extra difficult to find *Ss* who scored high in one test and low in the other.

TABLE 1

CHARACTERISTICS OF THE TOTAL SAMPLE WITH RESPECT TO AGE, AND SCORES IN THE OTIS AND THE DAT ABSTRACT REASONING TESTS OF MENTAL ABILITY

		GROUP					
		EXPERIMENTAL			CONTROL		
LEVEL		AGE	OTIS	DAT	AGE	OTIS	DAT
n = 15	M	17.00	43.40	40.87	16.80	41.93	41.00
HH	S.D.	0.72	5.40	3.47	0.75	3.69	1.83
n = 10	M	16.70	43.60	30.60	16.90	42.20	28.90
HL	S.D.	0.46	4.23	3.49	0.70	1.83	3.75
n = 10	M	16.80	27.80	41.20	16.80	25.80	42.10
LH	S.D.	0.75	3.27	2.04	0.75	4.14	2.46
n = 15	M	17.46	8.40	8.73	17.28	9.14	7.86
LL	S.D.	1.01	2.30	3.03	0.74	2.54	3.13

Conditioning Task and Procedure

Each *S* was instructed to say as many words as he could in two minutes for every trial. There were 10 trials in all. A stop watch was used to signal the beginning and the end of the task at every trial. Words ending in *tion* or *sion, ity,* and *ble* were reinforced. When the word given belonged to the response class, the E repeated the word and put a check (√) on a tally sheet which was within view of the *S*. If the word did not belong to the response class, a cross (X) was made on the tally sheet. A one-minute rest was given after every trial.

Post-Experimental Measures

Right after the experiment each *S* was asked to write his thoughts and observations about the experiment. If the thoughts and observations during the experiment could not be clearly construed as verbalization of awareness, the questionnaire for the measurement of awareness was given to the *S*. Below was the questionnaire used:

Answer briefly the following questions:

1. Did you notice anything in particular that the experimenter did when you were giving words?
2. If yes, what and when did you notice?
3. How did you react to this? What did you do?
4. Did you get the feeling that you were to say certain kinds of words more than any others? Why?
5. Did you think of certain kinds of words to say? If yes, which particular kinds of words are these? Why?
6. What do you think the check marks were for? the cross marks? Did you not attempt to find out what they were for?

Only the first three questions were given to the *S*. Then, if still, the answers could not be clearly construed as verbalization of awareness, the last three questions were asked.

Statistical Treatment of Data

Since the experimental *S*s were conditioned only to words ending in *tion* or *sion,* their scores for this particular response class were the only ones included in the analysis.

The 50 *S*s in the experimental group were classified into aware or unaware on the basis of their answers to the questionnaire given at the end of the experiment and their introspective reports. A Chi-Square was computed to determine if levels of intelligence were correlated to the apparent differences in reports of awareness.

RESULTS

The results of our study suggest differential outcomes for experimental and control groups on the response measure in various respects. Table 2 indicates that all main effects were significant. The experimental *S*s were superior to the control *S*s in average output of the reinforced response class ($F = 18.2833; df = 1, 92; p < .001$).

TABLE 2

ANALYSIS OF VARIANCE OF THE VERBAL CONDITIONING SCORES

SOURCE	df	MS	F
Between Subject Analysis			
Groups (G)	1	26.7745	18.2833***
Levels (L)	3	19.2458	13.1422***
Groups X Levels	3	7.5805	5.1764**
Error (a)	92	1.4644	
Within Subject Analysis			
Trials (T)	9	1.0802	4.3916*
Trials X Groups	9	0.3345	1.3599
Trials X Levels	27	0.0467	0.1898
T X G X L	27	1.3426	5.4585**
Error (b)	828	0.2459	
TOTAL	999		

***$p < .001$
**$p < .01$
*$p < .05$

The means of score levels also differed systematically ($F = 13.1422; df = 3, 92; p < .001$), suggesting that the level of intelligence is related somehow to the presence or absence of conditioning, that is, our data support the notion that the amount (See Fig. 1(a)) and rate (See Fig. 4(a)) of conditioning co-vary with level of intelligence.

Furthermore, Fig. 2 makes it obvious that increments in performance are a function of stage of practice ($F = 4.3916; df = 9, 828, p < .05$). The *F* ratio though significant, is small, but it must be remembered that the scores of the control group were included in the computation of the *F* ratio here. A test for trend utilizing only the average trial-to-trial performance of the

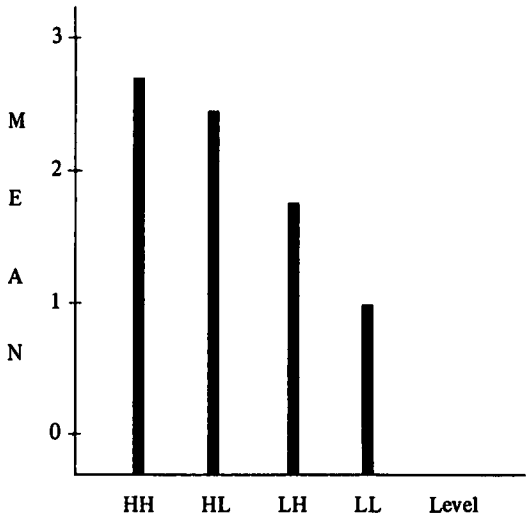

FIG. 1(a) – MEAN OF CORRECT RESPONSE FOR LEVELS, EXPERIMENTAL AND CONTROL GROUPS COMBINED

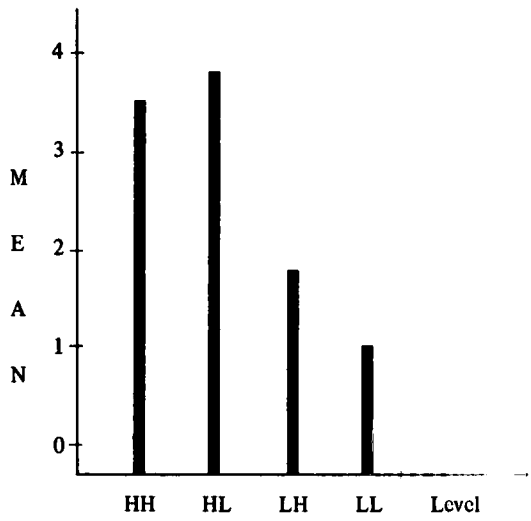

FIG. 1(b) – MEAN OF CORRECT RESPONSE FOR LEVELS FOR THE EXPERIMENTAL GROUP ALONE

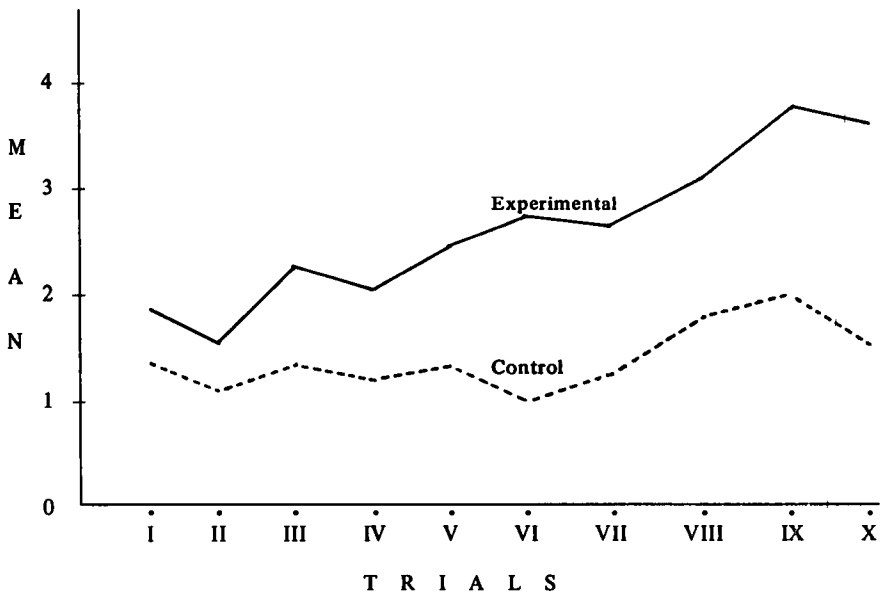

FIG. 2 – AVERAGE TRIAL-BY-TRIAL PERFORMANCE OF EXPERIMENTAL AND CONTROL GROUPS IN THE VERBAL OPERANT CONDITIONING TASK

experimental *S*s would have yielded a much larger *F* ratio, but would have simply obviated what is already apparent in Fig. 2 and Table 2.

In addition, there is a significant interaction between "Groups" and "Levels" (F (3,92) = 5.1764; $p < .01$). This interaction was unexpected and is, in principle, illogical, because it suggests that some of the control *S*s did significantly better than the experimental *S*s, even when the former were not given any consistent reinforcement. This interaction, then, requires some explanation. Close inspection of Fig. 3 indicates that the observed interaction is largely a function of differential performance within levels of the experimental group, but not in the control group. This fact is further illustrated in the average-trial-by-trial output of experimental and control *S*s, segregated in terms of intelligence level as shown in Figures 4(a), (b).

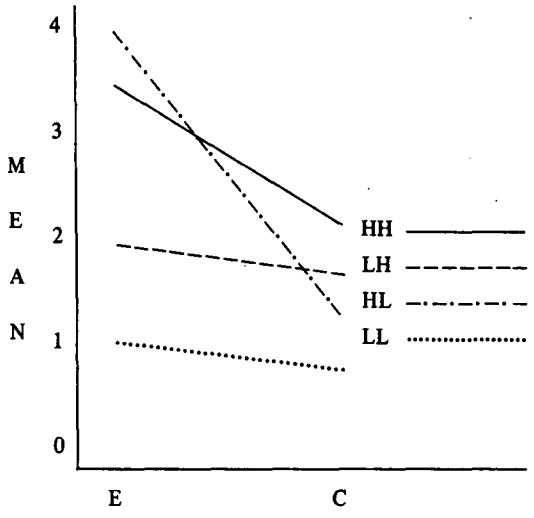

FIG. 3 – INTERACTION EFFECTS OF GROUPS (EXPERIMENTAL, CONTROL) AND LEVEL OF INTELLIGENCE (HH, HL, LH, LL).

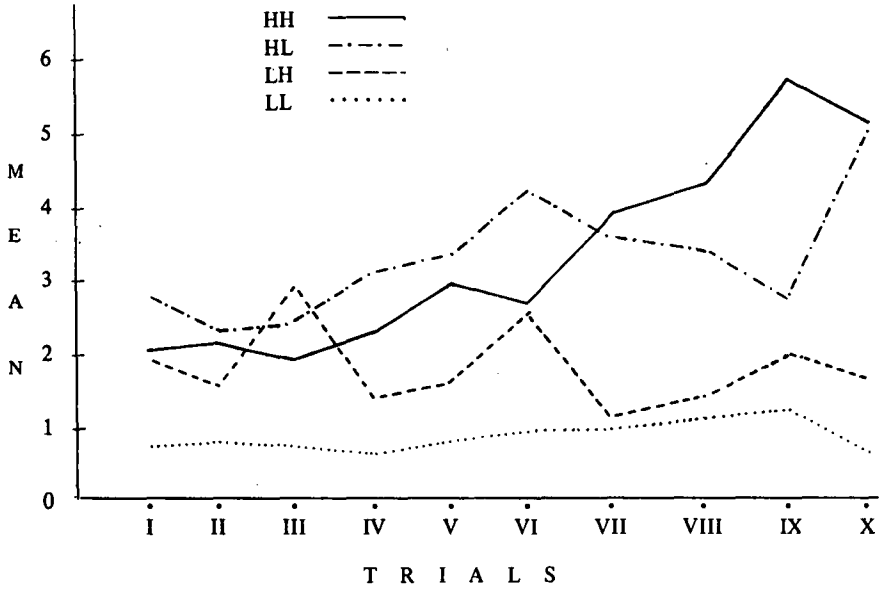

FIG. 4(a) – LEARNING CURVES COMPARING *S*S' PERFORMANCE AT DIFFERENT LEVELS OF INTELLIGENCE FOR THE EXPERIMENTAL GROUP.

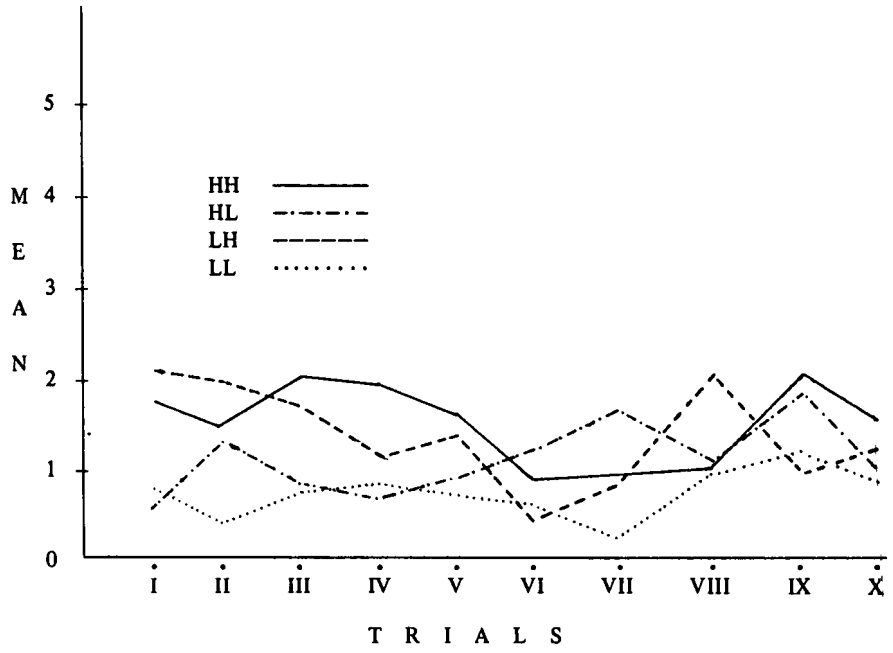

FIG. 4(b) – LEARNING CURVES COMPARING *S*s' PERFORMANCE AT DIFFERENT LEVELS OF INTELLIGENCE FOR THE CONTROL GROUP.

The significant second-order interaction (Groups x levels x Trials, $F = 5.4585$; $df = 27, 828$; $p < .05$) does not lend itself to a straight-forward interpretation, and has no obvious empirical meaning of its own.

Finally, when the *S*s of the experimental group were placed in a situation where they could verbalize their awareness of the response-reinforcement contingency, the *S*s with higher intelligence-test scores did so more readily than individuals with lower scores on the same tests. That is to say, there seems to be a consistent correlation between intelligence-test scores ($X^2 = 27.2000$; $df = 3$; $p < .001$; $n = 50$). As a matter of fact, Cramer's statistics[3] reached a value of $\phi' = .74$, attesting to the strength of this relationship. It is clear from Table 3 that verbalization of awareness co-varied with level of intelligence.

TABLE 3

CONTINGENCIES OF AWARE-UNAWARE RESPONSES CROSS CLASSIFIED WITH LEVEL OF INTELLIGENCE

Level	TYPE OF RESPONSE	
	AWARE	UNAWARE
HH	12	3
HL	9	1
LH	4	6
LL	0	15

($X^2_3 = 27.20000$; $p < .001$)

DISCUSSION

Generally, the results indicated that there was differential improvement in the experimen-

[3]Cramer's statistic is $\phi' = \sqrt{\frac{X^2}{N(L-1)}}$; L is the number of *df*'s in the rows or the column, whichever is smaller (Hays, 1963, page 606).

tal group and no differential performance for the control group. This can only be interpreted to mean that the reinforcing cue was effective in increasing the output of reinforced *Ss* in terms of the selected response class. However, not all the experimental *Ss* improved, and this can be seen clearly if we segregate them according to their level of intelligence (See Fig. 1). It is significant to note, too, that the percentage of their correct responses during the latest trials never went beyond 50%. These two significant observations above can possibly be explained if we now proceed to consider the factors that might have affected the *Ss*' performance.

Verbal Conditioning and Intelligence

Our data show that the more intelligent *Ss* obtained a decidedly greater increase in their scores than the less intelligent ones. As a matter of fact the *Ss* in the LL Level exhibited no improvement at all. It can be said, too, that the *Ss* differed in their degree and rate of conditioning. Notice that in Fig. 4(a) the HH experimental group started at a higher level than the LL experimental group, and their progress is apparent as contrasted with the performance of the experimental LL *Ss*. More intelligent individuals, apparently, learned better than less intelligent ones.

It will be recalled that two tests were administered to select the *Ss*, one, a test that depends largely upon verbal ability, the Otis, and one that is nonverbal, mostly perceptual in nature, the DAT Abstract Reasoning test. Obviously, *Ss* with high verbal test scores did consistently better than *Ss* with high nonverbal test scores. We observe that in Fig. 1(a) learning seemed to be good where the *Ss* who scored within the highest 5% of the verbal test were assigned. In fact, considering only the performance of the experimental group (See Fig. 1(b)), the HL Level would have the highest mean frequency of correct response. Performance on a verbal conditioning task of the kind used in the present experiment seems to depend on verbal proficiency. It appears that verbal proficiency and verbal conditioning are positively correlated. This relationship is logically tenable but it still has to be empirically demonstrated. Moreover, since the Otis is not a test of pure verbal ability, it cannot be said that the foregoing inference is entirely accurate. Perhaps, verbal proficiency simply facilitates the availability of the emitted response, but that general ability or what we might call intelligence, is necessary for adequate learning to occur. This notion accompanies the fact that verbal operant conditioning in human *Ss* is close to a problem-solving task.

Verbal Conditioning, Awareness, and Intelligence

Early experiments on verbal conditioning were concerned mainly with the analysis of the effects of certain reinforcement stimuli on the *Ss*' performance and with a non-analytical determination of whether learning takes place in the absence of awareness or not. Later investigators, the cognitive theorists, turned to proving that awareness mediates performance on a verbal conditioning task. Recently, the position of the behaviorists (Krasner, 1967) is not that awareness is absent during learning; the present issue is whether awareness is a necessary condition for learning or whether learning and awareness are correlated in a non-functional manner.

The present study is non-analytical. It was not designed to determine the onset of awareness to see whether it precedes or follows improvement in performance, hence no attempt was made here to relate the results to the issue regarding the awareness controversy. Some interesting observations made in the present experiment are as follows:

1) *Ss* who improved their performance were also able to verbalize their awareness of the response-reinforcement contingency.

2) More intelligent *Ss* verbalized their awareness more often than less-intelligent *Ss*.

3) More intelligent *Ss* also conditioned sooner than less-intelligent *Ss*.

In the light of the above one may be tempted to ask whether intelligence facilitates awareness or not. Our data do not allow us to answer such a question. This question can be answered only by an experiment where highly intelligent *Ss*, as

well as not too intelligent *S*s, all became conditioned, but manifested differential degrees of awareness. That awareness facilitates learning is another question that we cannot answer here. Our data show a covariance, but the same data may be used successfully to defend a mutually exclusive viewpoint, namely, that *S*s catch themselves giving a correct response, then they verbalize the situation; that is, it could also be said from these data, that awareness is a result of learning.

It was observed that the percentage of correct response of the *S*s who were considered "conditioned" and classified as "aware" never went beyond 50%. A few speculations can be offered to account for this small percentage of correct response during the latest trials. One of the many uncontrolled factors that affect a verbal conditioning situation is the type of reinforcement used. It could be that in the present study the reinforcing stimuli used, had what we might call low-level magnitude of reinforcement. In an exploratory study at the Ateneo de Manila University Experimental Psychology Laboratory, the relationship between type of reinforcement and conditioning was investigated using 18 *S*s. In one situation *E* was visible to the *S*s, and reinforced them by saying "right" to a correct response, and in another, *E* was not visible to the *S*s and the word "right" was not said after a correct response, *E* simply repeating out loud every correct response. In the first situation, there was great improvement in the *S*s' performance whereas in the latter situation the *S*s appeared not to have learned. This question of type or magnitude of reinforcement calls attention for future research. It ought to be duly explored as an independent variable with both awareness and performance as dependent variables (e.g., "right" vs "mm–hmm"). It can also be further speculated that, in the present study, the instruction to give as many words as they could might have established a "set" for speed which was incompatible with the application of the principle of reinforcement in that it gave *S* little opportunity to translate knowledge of the principle into correct performance. Moreover, the fact that they were under time pressure might have also exerted influence in their performance. To go further, it should be noted also that in a verbal conditioning task of the kind used in our study, the hypothesis with respect to the experimental contingencies can be tested in part, by not giving the reinforced response. This possibility explains also the slight fluctuations in the *S*s performance.

As a conclusion, the salient points in the discussion may be summarized through the following statements:

1) The study has demonstrated reliable covariance of intelligence and rate and amount of conditioning.

2) It has shown reliable covariance between intelligence and verbalization of response reinforcement contingency.

3) It has shown reliable covariance between improvement of performance and verbalization of awareness.

4) A positive relationship between verbal proficiency and verbal conditioning is logically tenable but has to be empirically demonstrated.

5) The role of general ability or intelligence in verbal conditioning needs a more systematic investigation and further study.

6) The problem of magnitude of reinforcement as an independent variable in the study of both conditioning and the development of awareness is a significant area that calls for research.

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